Maharashtra State Board of Technical Education, Mumbai

Teaching And Examination Scheme For Post S.S.C. Diploma Courses

Program Name : Diploma in Electrical Engineering

Program Code : EE/EP/EU **With Effect From Academic Year: 2017 - 18**

Duration of Program : 6 Semesters **Duration : 16 Weeks**

Semester : Second **Scheme : I**

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total
								Theory							Practical					
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total	
				L	T	P			Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
1	Applied Mathematics	AME	22210	4	2	-	6	3	70	28	30*	00	100	40	--	--	--	--	--	--	100
2	Applied Science – Physics	ASE	22211	2	-	2	6	90 Min	70*#	28	15*	00	100	40	25@	10	25	10	50	20	200
	Applied Science – Chemistry			2	-						15*	00			25@	10	25	10	50	20	
3	Fundamentals of Electrical Engineering	FEE	22212	4	2	2	8	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
4	Elements of Electronics	EOE	22213	3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20	150
5	Basic Mechanical Engineering	BME	22214	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150
6	Business Communication Using Computers	BCC	22009	-	-	2	2	--	--	--	--	--	--	--	35@^	14	15~	06	50	20	50
		Total		**18**	**4**	**10**	**32**	--	**350**	--	**150**	--	**500**	--	**160**	--	**140**	--	**300**	--	**800**

Student Contact Hours Per Week: **32 Hrs.** Medium of Instruction: **English**

Theory and practical periods of 60 minutes each. Total Marks : **800**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, *# On Line Examination , ^ Computer Based Assessment

* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment (5 marks each for Physics and Chemistry) to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

- **It is mandatory for the candidate to appear for practical (ESE) of both the part of Applied Science (Physics & Chemistry). Candidate remaining absent in exam of any one part, will be considered as absent for the head ESE (PR) of Applied Science.**
- **If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.**

Program Name : **Electrical Engineering Program Group & Electronics Engineering Program Group**
Program Code : **DE/EE/EJ/IE/IS/MU**
Semester : **Second**
Course Title : **Applied Mathematics**
Course Code : **22210**

1. RATIONALE

The core technological studies can be understood with the help of potential of applied mathematics. This course is an extension of Basic Mathematics of first semester which is designed for its applications in engineering and technology using the techniques of calculus, differentiation, integration, differential equations and in particular complex numbers and Laplace transform. Derivatives are useful to find slope of the curve, maxima and minima of the function, radius of curvature. Integral calculus helps in finding the area. In analog to digital converter and modulation system integration is important. Differential equation is used in finding the curve and its related applications for various engineering models like LCR circuits. This course further develops the skills and understanding of mathematical concepts which underpin the investigative tools used in engineering.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Solve electrical and electronics engineering related broad-based problems using the principles of applied mathematics.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following ***industry oriented*** COs associated with the above mentioned competency:

a. Calculate the equation of tangent, maxima,minima,radius of curvature by differentiation.
b. Solve the given problem(s) of integration using suitable methods.
c. Apply the concepts of integration to find the area and volume.
d. Solve the differential equation of first order and first degree using suitable methods.
e. Use Laplace transform to solve first order first degree differential equations.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
				Paper	ESE		PA		Total		ESE		PA		Total	
L	T	P		Hrs.	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	2	--	6	3	70	28	30*	00	100	40	--	--	--	--	--	--

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of UOs required for the attainment of the COs.
Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***ESE*** *-End Semester Examination;* ***PA*** *- Progressive Assessment*

5. COURSE MAP (with sample COs, Unit Outcomes i.e. UOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

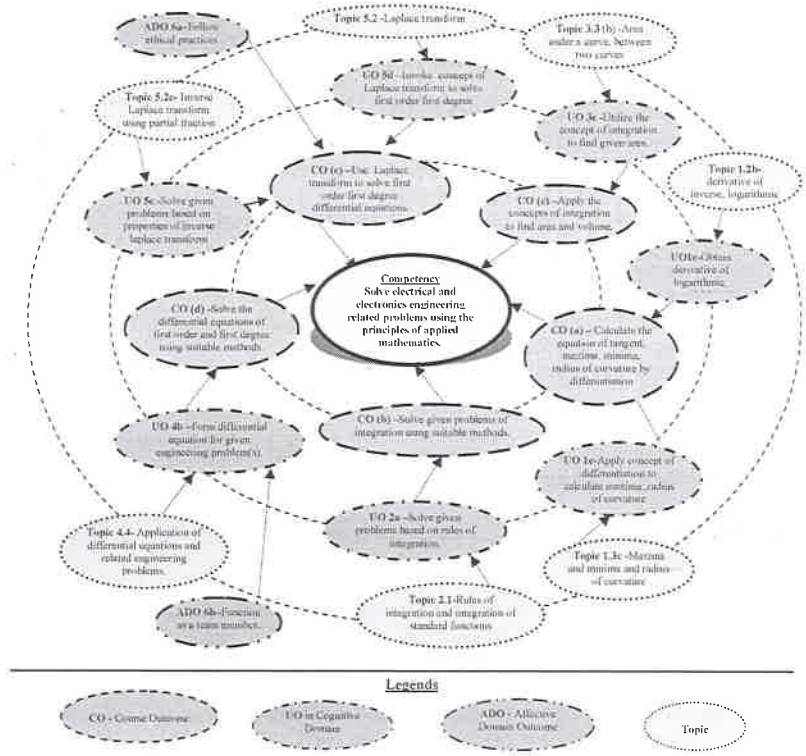

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The tutorials in this section are sub-components of the COs to be developed and assessed in the student to lead to the attainment of the competency.

S. No.	Tutorials	Unit No.	Approx. Hrs. Required
1	Solve problems based on finding value of the function at different points.	I	2
2	Solve problems to find derivatives of implicit function and parametric function	I	2
3	Solve problems to find derivative of logarithmic and exponential functions.	I	2
4	Solve problems based on finding equation of tangent and normal.	I	2
5	Solveproblems based on finding maxima, minima of function and radius of curvature at a given point.	I	2
6	Solve the problems based on standard formulae of integration.	II	2
7	Solve problems based on methods of integration, substitution, partial fractions.	II	2
8	Solve problems based on integration by parts.	II	2
9	Solve practice problems based on properties of definite integration.	III	2
10	Solve practice problems based on finding area under curve, area between two curves and volume of revolutions.	III	2
11	Solve the problems based on formation, order and degree of differential equations.	IV	2
12	Develop a model using variable separable method to related engineering problem.	IV	2
13	Develop a model using the concept of linear differential equation to related engineering problem.	IV	2
14	Solve problems based on algebra of complex numbers.	V	2
15	FindLaplace transform and inverse Laplace transformusing related properties.	V	2
16	Make use of concept of Laplace transform to solve first order first degree differential equation.	V	2
			32

Note: The above tutorial sessions are for guideline only. The remaining tutorial hours are for revision and practice.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

- Not applicable -

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Differential Calculus	1a. Solve the given simple problems based on functions. 1b. Solve the given simple problems based on rules of differentiation. 1c. Obtain the derivatives of logarithmic,exponential functions. 1d. Apply the concept of differentiation to find equation of tangent and normal. 1e. Apply the concept of differentiation to calculate maxima and minima and radius of curvature of given problem.	1.1 Functions and Limits : a) Concept of function and simple examples b) Concept of limits without examples. 1.2 Derivatives : a) Rules of derivatives such as sum, product, quotient of functions. b) Derivative of composite functions (chain Rule), implicit and parametric functions. c) Derivatives of inverse, logarithmic and exponential functions. 1.3 Applications of derivative : a) Second order derivative without examples. b) Equation of tangent and normal c) Maxima and minima d) Radius of curvature
Unit– II Integral Calculus	2a. Solve the given problem(s) based on rules of integration. 2b. Obtain the given simple integral(s) using substitution method. 2c. Integrate given simple functions using the integration by parts. 2d. Evaluate the given simple integral by partial fractions.	2.1 Simple Integration: Rules of integration and integration of standard functions. 2.2 Methods of Integration: a) Integration by substitution. b) Integration by parts c) Integration by partial fractions.
Unit– III Applications of Definite Integration	3a. Solve given simple problems based on properties of definite integration. 3b. Apply the concept of definite integration to find the area under the given curve(s). 3c. Utilize the concept of definite integration to find area between given two curves. 3d. Invoke the concept of definite integration to find the volume of revolution of given surface.	3.1 Definite Integration: a) Simple examples b) Properties of definite integral (without proof) and simple examples. 3.2 Applications of integration : a) Area under the curve. b) Area between two curves. c) Volume of revolution.
Unit-IV First Order First Degree Differential Equations	4a. Find the order and degree of given differential equations. 4b. Form simple differential equations for given engineering problem(s). 4c. Solve the given differential equations using the method of variable separable. 4d. Solve the given problems based on linear differential equations.	4.1 Concept of differential equation 4.2 Order, degree and formation of differential equation. 4.3 Solution of differential equation a. Variable separable form. b. Linear differential equation. 4.4 Application of differential equations and related engineering problems.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit –V Complex Numbers and Laplace transform.	5a. Solve given problems based on algebra of complex numbers. 5b. Solvethe given problems based on properties of Laplace transform 5c. Solve the given problems based on properties of inverse Laplace transform. 5d. Invoke the concept of Laplace transform to solve first order first degree differential equations.	5.1 Complex numbers: a. Cartesian, polar and exponential form of a complex number. b. Algebra of complex numbers. 5.2 Laplace transform: a. Laplace transform of standard functions (without proof). b. Properties of Laplace transform such as linearity, first and second shifting properties (without proof). c. Inverse Laplace transform using partial fraction method, linearity and first shifting property. d. Laplace transform of derivatives and solution of first order first degree differential equations.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Differential calculus	20	04	08	12	24
II	Integral calculus	14	02	06	08	16
III	Applications of Definite Integration	10	02	02	04	08
IV	First Order First Degree Differential Equations	08	02	02	04	08
V	Complex numbers and Laplace transform	12	02	05	07	14
Total		**64**	**12**	**23**	**35**	**70**

***Legends**: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Identify engineering problems based on real world problems and solve with the use of free tutorials available on the internet.
b. Use graphical software's: EXCEL, DPLOT, and GRAPH for related topics.
c. Use Mathcad as Mathematical Tools and solve the problems of Calculus.

d. Identify problems based on applications of differential equations and solve these problems.
e. Prepare models to explain different concepts of applied mathematics.
f. Prepare a seminar on any relevant topic based on applications of integration.
g. Prepare a seminar on any relevant topic based on applications of Laplace transform to related engineering problems.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide student(s) in undertaking micro-projects.
f. Apply the mathematical concepts learnt in this course to branch specific problems.
g. Use different instructional strategies in classroom teaching.
h. Use video programs available on the internet to teach abstract topics.

12. SUGGESTED MICRO-PROJECTS

Only ***one micro-project*** is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare models using the concept of tangent and normal to bending of roads in case of sliding of a vehicle.
b. Prepare models using the concept of radius of curvature to bending of railway track.
c. Prepare charts displaying the area of irregular shapes using the concept of integration.
d. Prepare charts displaying volume of irregular shapes using concept of integration.
e. Prepare models using the concept of differential equations for mixing problem.
f. Prepare models using the concept of differential equations for radio carbon decay.
g. Prepare models using the concept of differential equations for population growth.
h. Prepare models using the concept of differential equations for thermal cooling.
i. Prepare models using the concept of Laplace transform to solve linear differential equations.

j. Prepare models using the concept of Laplace transform to solve initial value problem of first order and first degree.
k. Prepare charts displaying various algebraic operations of complex numbers in complex plane.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Higher Engineering Mathematics	Grewal, B.S.	Khanna publications, New Delhi , 2013 ISBN- 8174091955
2	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publications, New Delhi, 2016 ISBN:978-81-265-5423-2.
3	Advanced Engineering Mathematics	Das, H.K.	S. Chand Publications, New Delhi, 2008, ISBN-9788121903455
4	Engineering Mathematics, Volume 1 (4th edition)	Sastry, S.S.	PHI Learning, New Delhi, 2009 ISBN-978-81-203-3616-2.
5	Getting Started with MATLAB-7	Pratap, Rudra	Oxford University Press, New Delhi,2009 ISBN- 0199731241
6	Engineering Mathematics (third edition).	Croft, Anthony.	Pearson Education, New Delhi,2010 ISBN 978-81-317-2605-1

14. SOFTWARE/LEARNING WEBSITES

a. www.scilab.org/ - SCI Lab
b. www.mathworks.com/products/matlab/ - MATLAB
c. Spreadsheet applications
d. www.dplot.com/ - DPlot
e. www.allmathcad.com/ - MathCAD
f. www.wolfram.com/mathematica/ - Mathematica
g. http://fossee.in/
h. https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaAoddHoPig
i. www.easycalculation.com
j. www.math-magic.com

Program Name : **Electrical Engineering Program Group**
Program Code : **EE/EP/EU/IE/IS**
Semester : **Second**
Course Title : **Applied Science (Physics & Chemistry)**
Course Code : **22211**

1. RATIONALE

Diploma engineers (also called technologists) have to deal with various materials and machines. The study of concepts and principles of science like capacitance and current electricity, electromagnetic induction and alternating current, photo-sensors and LASER, water treatment and analysis, electrochemistry and batteries, metals, alloys, insulators and others will help them in understanding the engineering courses where emphasis is laid on the applications. This course is developed in the way by which fundamental information will help the diploma engineers to apply the concepts and principles of advanced science in various engineering applications to solve broad based problems.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Apply principles of advanced physics and chemistry to solve broad based engineering problems.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a. Use relevant capacitors in electrical circuits.
b. Use equipment/instruments based on radioactive and ultrasonic principles.
c. Use equipment/instruments based on photoelectric effect, X-Ray and LASER.
d. Select relevant water treatment process for various applications.
e. Use relevant electrolyte in batteries for different applications.
f. Use relevant metals, alloys and insulating materials in various applications.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
L	T	P			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
2	-	2	6	90 Min	70*#	28	15*	00	100	40	25@	10	25	10	50	20
2	-						15*	00			25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment (5 marks each for Physics and Chemistry) to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *- Practical;* ***C*** *– Credit,*
ESE *- End Semester Examination;* ***PA*** *- Progressive Assessment*
Note: *Practical of Chemistry and Physics will be conducted in alternate weeks for each batch.*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

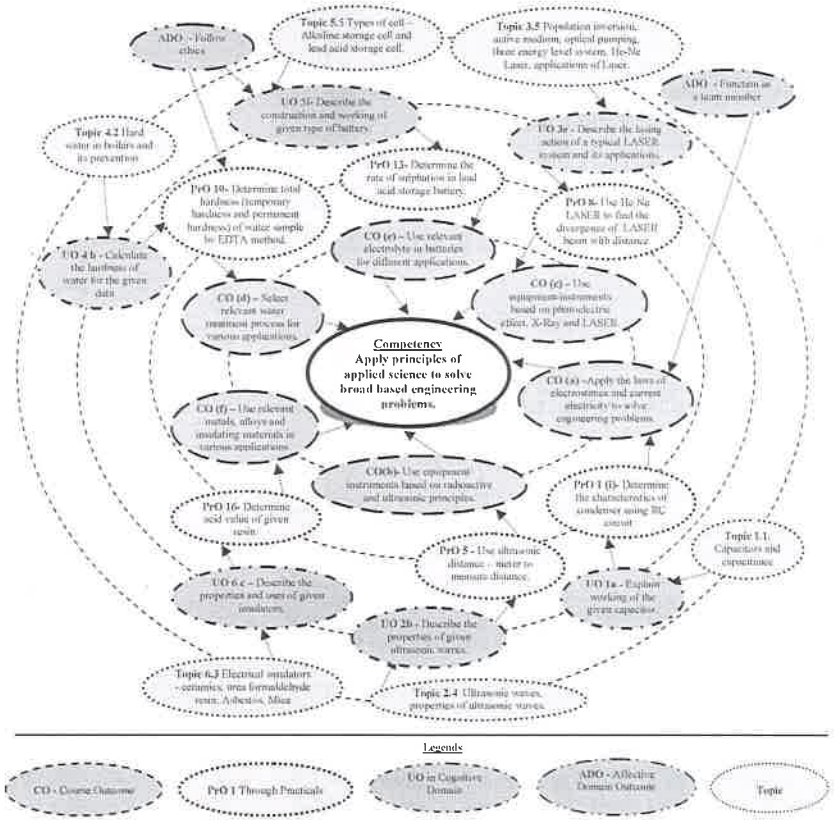

Figure 1 - Course Map

6. SUGGESTED PRACTICALS / EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	Physics		
1	i) Use condensers to increase and decrease the equivalent capacity of the circuit. ii) Determine the characteristics of condenser using RC circuit.	I	02
2	i) Use meter bridge to determine the equivalent resistance of the conductors in series and parallel. ii) Use meter bridge to estimate specific resistance of a given wire.	I	02
3	i) Use potentiometer to compare emf of two cells. ii) Use potentiometer to find internal resistance of a cell.	I	02
4	Use resonance tube to determine velocity of sound.	II	02
5	Use ultrasonic distance – meter to measure distance.	II	02
6	i) Use photoelectric cell to see the dependence of photoelectric current on intensity of light. ii) Use photoelectric cell to see the dependence of photoelectric current on plate potential.	III	02
7	Use LDR to see the dependence of resistance of LDR on intensity of light.	III	02
8	Use He Ne LASER to find the divergence of LASER beam with distance.	III	02
	Chemistry		
9	Determine alkalinity of water sample	IV	02
10	Determine total hardness (temporary hardness and permanent hardness) of water sample by EDTA method.	IV	02*
11	Determine specific conductance and equivalence conductance of given salt sample solution.	V	02
12	Determine equivalence point of acetic acid and ammonium hydroxide using conductivity meter.	V	02*
13	Determine chloride contents in a given water sample by Mohr's method	V	02
14	Prepare the Thiokol rubber.	VI	02
15	Separate two miscible liquids like acetone and water using distillation technique.	VI	02
16	Determine acid value of given resin.	VI	02*
		Total	32

Note

i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
	Total	**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safe practices.
b. Practice good housekeeping.
c. Practice energy conservation.
d. Demonstrate working as a leader/a team member.
e. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
1	Digital multimeter : 3½ digit display, 9999 counts digital multimeter measures: V_{ac}, V_{dc} (1000V max), A_{dc}, A_{ac} (10 amp max), Hz, Resistance (0 - 100 MΩ), capacitance and Temperature	1,2,3,6,7
2	Micrometer screw gauge : Range : 0-25mm, Resolution: 0.01mm Accuracy: ±0.02mm or better	2
3	Resistance Box: 4 decade ranges from 1 ohm to 1KΩ, accuracy:0.1%-1%	1,2,3,6,7
4	Battery eliminator : 0-12 V, 2A	1,2,3,6,7
5	Meter bridge, Galvanometer and Jockey	2
6	Potentiometer	3
7	Ultrasonic distance meter	5
8	Resonance tube, tuning fork	4
9	Daniel cell and Leclanche cell	2
10	LASER kit	8
11	Conductivity meter; conductivity range – 0.01 uS/cm to 200 mS/cm, Cell constant – digital 0.1 to 2.00; Temp. range – 0 to 100°C	11,12
12	Electronic balance, with the scale range of 0.001gm to 500gm pan size	All

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
	100 mm; response time 3-5 sec.; power requirement 90-250V, 10 watt	
13	Simple distillation unit	15

8. UNDERPINNING THEORY COMPONENTS

9. The following topics/subtopics are to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	Physics	
Unit – I Electricity and Capacitance	1a. Explain working of the given capacitor. 1b. Calculate the equivalent capacity and energy stored in the given combination of capacitors 1c. Calculate the voltage in various components of the given electric circuit. 1d. Calculate the value of the given resistance using the principle of Wheatstone's bridge. 1e. Calculate the emf of the given cell using potentiometer.	1.1 Capacitors and capacitance. 1.2 Parallel plate capacitor, effect of dielectric on capacitance 1.3 Combination of capacitors, energy stored in a capacitor. 1.4 Cells, emf of cell, internal resistance of cell, Kirchhoff's laws, Wheatstone's bridge. 1.5 Potential gradient, potentiometer.
Unit– II Radioactivity and Ultrasonic Waves	2a. Describe the phenomenon of radioactivity for the given system. 2b. Calculate half-life period of given radioactive substance. 2c. Calculate the value of the period, frequency and velocity of the given type of wave. 2d. Describe the properties of given ultrasonic waves. 2e. Describe the properties of the given Piezo-electric material. 2f. Explain the production of ultrasonic waves using the given equipment. 2g. Describe the Doppler effect for the given application.	2.1 Radioactivity, α, β and γ particles/ rays and their properties, 2.2 Radioactive decay law, half-life period. 2.3 Sound waves, amplitude, frequency, time - period wave-length and velocity of wave, relation between velocity, frequency and time - period of wave. 2.4 Ultrasonic waves, properties of ultrasonic waves. 2.5 Piezo-electric effect. Piezo materials; Natural: Quartz, Synthetic: Gallium orthophosphate 2.6 Generation of ultrasonic waves using Piezo electric effect. 2.7 Applications of ultrasonic waves. 2.8 Doppler Effect and its applications.
Unit– III Photo electricity,	3a. Explain concept of photoelectric effect for the given materials. 3b. Explain the working of the given	3.1 Planck's hypothesis, properties of photons, photoelectric effect: threshold frequency, threshold

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
X-Rays and LASERs	photoelectric cell and LDR.	wavelength, stopping potential, Work function, characteristics of photoelectric effect, Einstein's photoelectric equation. 3.2 Photoelectric cell and LDR: principle, working and applications.
	3c. Explain the production of X-Rays from given material with its properties and applications.	3.3 Production of X-rays by Modern Coolidge tube, properties and applications of X-rays.
	3d. Differentiate between LASER and given colour of light. 3e. Describe the lasing action of a typical LASER system and its applications.	3.4 Laser, properties of laser, absorption, spontaneous and stimulated emission. 3.5 Population inversion, active medium, optical pumping, three energy level system, He-Ne Laser, applications of Laser.
	Chemistry	
Unit-IV Water treatment and analysis	4a. Describe the hardness in given water source. 4b. Calculate the hardness of water for the given data. 4c. Describe the effects of hard water in the given boilers. 4d. Explain the given type of water softening process. 4e. Describe the purification of municipal water for the given process. 4f. Describe the reverse osmosis process for the given type of water. 4g. Describe the given process of desalination of water.	4.1 Hardness: Types of hardness, soap solution method, EDTA method. 4.2 Effect of hard water in boilers and prevention: Boiler corrosion, caustic embrittlement, priming and foaming, scales and sludges 4.3 Water softening: Lime soda process (hot lime soda and cold lime soda process), zeolite process, ion exchange process (cation exchange and anion exchange). 4.4 Municipal water treatment: Sedimentation, coagulation, filtration and sterilization. 4.5 Waste water: Characteristics, BOD and COD, Sewage treatment, recycling of waste water. 4.6 De-salination process by reverse osmosis.
Unit –V Electrochemistry and Batteries	5a. Differentiate the electrical conductance in given metals and electrolytes. 5b. Identify factors affecting conductivity of the given solution. 5c. Describe construction of given	5.1 Electrical conductance in metals and electrolytes, specific conductance, equivalent conductance, cell constant. 5.2 Conductance: Nature of solute, nature of solvent, temperature, concentration or dilution.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	electrodes. 5d. Describe the process for calculation of the strength of given acid and base. 5e. Calculate specific and equivalent conductance of given electrolyte. 5f. Describe construction and working of given type of battery.	5.3 Electrodes: Hydrogen electrode, calomel electrode and glass electrode 5.4 Conductometric Titration: 5.5 Batteries- Dry cell, alkaline battery, lead Acid storage cell and Ni-Cd battery, H_2-O_2 fuel cell, Lithium ion battery.
Unit-VI Metals, Alloys and Insulators	6a. Describe the properties of the given metal. 6b. Select relevant thermocouple alloy for given application. 6c. Describe the properties and uses of the given insulators. 6d. Select relevant insulator for given system. 6e. Describe given techniques of unit operation.	6.1 Properties of metals like copper, Aluminium, tungsten, platinum nickel. 6.2 Thermocouple alloy: Composition and characteristics of nickel alloy, platinum/rhodium, tungsten/ rhenium, chromel-gold/iron. 6.3 Electrical insulators: Classification. Solid - ceramics, mica, asbestos, urea formaldehyde resin and glass. Liquid-silicon fluid, Gaseous-inert gases, hydrogen and nitrogen gas. 6.4 Types of rubber : Natural and, synthetic, processing of natural rubber. Synthetic rubber : Properties and applications of Buna-N, Thiokol, Neoprene. 6.5 Process industry unit operations: Evaporation, condensation, Distillation, Energy balance and mass balance for above processes. 6.6 Nanomaterials: Applications of Fullerence, Graphene

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

10. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	Physics					
I	Capacitance and current electricity	8	02	03	04	09
II	Radioactivity and ultrasonic waves	12	03	04	07	14
III	Photo-electricity, X-rays and LASER	12	03	04	05	12
	Chemistry					
IV	Water treatment and analysis	12	02	04	06	12
V	Electrochemistry and Batteries.	12	03	05	06	14
VI	Metals, Alloys, Insulators.	08	02	02	05	09
	Total	**64**	**15**	**22**	**33**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note: *This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

11. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Seminar on any relevant topic.
b. Library survey regarding Engineering Material used in different industries.
c. Prepare power point presentation or animation for showing applications of lasers.

12. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide student(s) in undertaking micro-projects.

13. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. **Capacitors:** Prepare the models of various types of capacitors.

b. **Current electricity:** Make one circuit with bulbs/ LED/ connected in parallel or series.
c. **Photosensors**: Prepare working model of simple photosensor using LED.
d. **LASER**: Prepare the presentation on the industrial application of LASER.
e. **Water analysis**: Collect water samples from different water sources and determined the acidity, conductivity, dissolved solids, suspended particles in the sample.
f. **Water treatment:** Collect 3 to 5 water samples from borewell and determined the dosage of bleaching powder required for its sterilization.
g. **Water analysis:** Determine the soap foaming capacity of bore water on addition of soda ash.
h. **Energy sources**: Prepare chart showing different types of energy sources with their advantages.
i. **Electrolytic Cells**: Collect fruit and vegetable and prepare working model of cell.
j. **Electric Insulators:** Collect the samples of different insulators and list their industrial applications .
k. **Thermocouple**: Prepare chart showing different types of thermocouples with their characteristics used in electronic and electrical industry .

14. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Physics Textbook Part I - Class XI	Narlikar, J. V.; Joshi, A. W.; Mathur, Anuradha; *et al*	National Council of Education Research and Training, New Delhi, 2010, ISBN : 8174505083
2	Physics Textbook Part II - Class XI	Narlikar, J. V.; Joshi, A. W.; Mathur, Anuradha; *et al*	National Council of Education Research and Training, New Delhi, 2015, ISBN : 8174505660
3	Physics Textbook Part I - Class XII	Narlikar, J.V.; Joshi, A. W.; *et al*	National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506314
4	Physics Textbook Part II - Class XII	Narlikar, J.V.; Joshi, A. W.; *et al*	National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506713
5	Engineering Chemistry	Agarwal, Shikha	Cambridge university press ; New Delhi,2015 ISBN :9781107476417
6	Engineering Chemistry	Dara, S. S.	S.Chand. Publication, New Delhi, 2013, ISBN: 8121997658
7	Engineering Chemistry	Jain & Jain	Dhanpat Rai and sons; New Delhi, 2015, ISBN :9352160002
8	Engineering Chemistry	Dr.Vairam, S.	Wiley India Pvt.Ltd. New Delhi, 2013 ISBN: 9788126543342
9	Chemistry for engineers	Agnihotri, Rajesh	Wiley India Pvt.Ltd. New Delhi, 2014 ISBN: 9788126550784

15. SOFTWARE/LEARNING WEBSITES

a. http://nptel.ac.in/course.php?disciplineId=115

b. http://nptel.ac.in/course.php?disciplineId=104
c. http://hperphysics.phy-astr.gsu.edu/hbase/hph.html
d. www.physicsclassroom.com
e. www.physics.org
f. www.fearofphysics.com
g. www.sciencejoywagon.com/physicszone
h. www.chemistryteaching.com
i. www.visionlearning.com
j. www.chem1.com
k. www.onlinelibrary.wiley.com
l. www.rsc.org
m. www.chemcollective.org
n. www.wqa.org
o. www.em-ea.org

Program Name : **Electrical Engineering Program Group**

Program Code : **EE/EP/EU**

Semester : **Second**

Course Title : **Fundamentals of Electrical Engineering**

Course Code : **22212**

1. RATIONALE

Technologists in electrical engineering are expected to handle electrical machines, instruments, devices and equipment's. Besides this, operations about power system, protection scheme and controls must be studied and developed by the students. The basic aim of this course is that, the student must learn the basic concepts, rules and laws of electric and magnetic circuits and practical's thereof. The basic concepts of electrical engineering in this course will be very useful for understanding of other higher level subjects in further study.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Use basic principles of electrical engineering in different applications.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a. Determine various parameters used in electric circuit.
b. Use of basic laws of electrical engineering.
c. Make use of capacitor in different conditions.
d. Use principles of magnetism.
e. Use principles of electromagnetism.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
				Paper	ESE		PA		Total		ESE		PA		Total	
L	T	P		Hrs.	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	1	2	7	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *- Practical;* ***C*** *– Credit,* ***ESE*** *- End Semester Examination;* ***PA*** *- Progressive Assessment*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

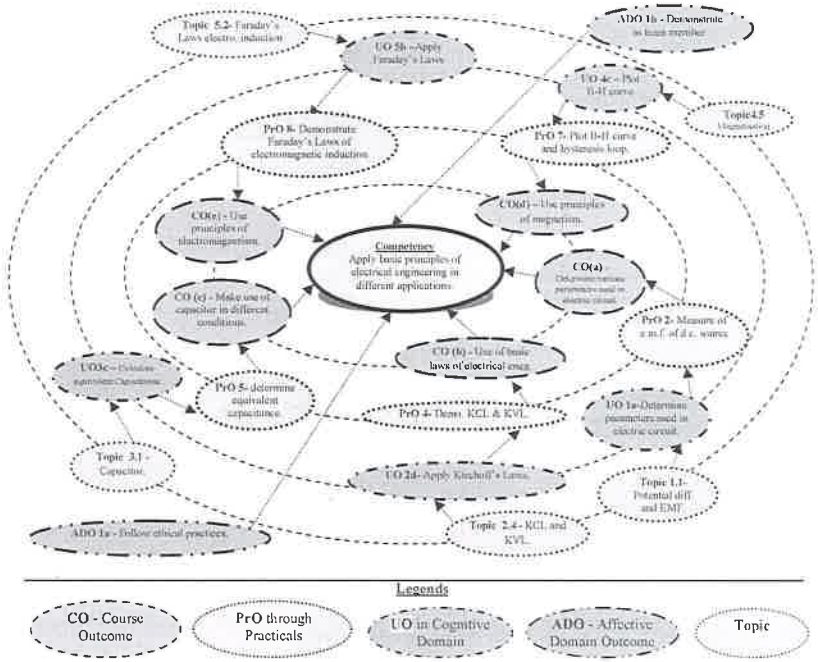

Figure 1 - Course Map

6. SUGGESTED PRACTICALS / EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Trace your electrical engineering laboratory: a. Draw layout of electrical laboratory. b. Prepare Charts of electrical safety and demonstrate the operation of fire extinguishing equipments. c. Demonstrate and use electric tools such as pliers, screw driver, insulation cutter, tester	I	02*
2	Measure of e.m.f. of d.c. source and to calculate its internal resistance by connecting it to an external load. Part I	I	02
3	Measure of e.m.f. of d.c. source and to calculate its internal resistance by connecting it to an external load. Part II	I	02
4	Determine the equivalent resistance of Series connection.	II	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
5	Determine the equivalent resistance of Parallel connection.	II	02
6	Use Kirchhoff's current law and Kirchhoff's voltage law to determine currents and voltages in electric circuits. Part I	II	02
7	Use Kirchhoff's current law and Kirchhoff's voltage law to determine currents and voltages in electric circuits. Part II	II	02
8	In the series connected circuits determine the equivalent capacitance.	III	02*
9	In the parallel connected circuits determine the equivalent capacitance.	III	02
10	Determine the time constant of RC circuit analytically and graphically including plotting the charging and discharging curves of a capacitor(C) through resistor (R). Part I	III	02
11	Determine the time constant of RC circuit analytically and graphically including plotting the charging and discharging curves of a capacitor(C) through resistor (R). Part II	III	02
12	For the given magnetic material find the B-H curve and hysteresis loop. Part I	IV	02*
13	For the given magnetic material find the B-H curve and hysteresis loop. Part II	IV	02
14	For the given magnetic material find the B-H curve and hysteresis loop. Part III	IV	02
15	Use Faraday's first law of electromagnetic induction to analyse the behaviors of statically induced e.m.f. and Dynamically induced e.m.f. in the given circuit. Part I	V	02*
16	Use Faraday's first law of electromagnetic induction to analyse the behaviors of statically induced e.m.f. and Dynamically induced e.m.f. in the given circuit. Part II	V	02
	Total		**32**

Note

*i. A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
	Total	**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Maintain tools and equipment.
e. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organizing Level' in 2nd year.
- 'Characterizing Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	D. C. Ammeter range (0-5A), Portable analog PMMC type as per relevant BIS standard	I
2	D.C. Voltmeter Range (0-150/300V), Portable analog PMMC type as per relevant BIS standard	I
3	D.C. Voltmeter Range (0-15/30/75 V), Portable analog PMMC type as per relevant BIS standard	II
4	Rheostat (0-250 Ohm,2A), Nichrome wire wound rheostat on epoxy resin or class F insulating tube with two fixed and one sliding contact	II
5	Rheostat (0-90 Ohm,5A), Nichrome wire wound rheostat on epoxy resin or class F insulating tube with two fixed and one sliding contact	III
6	Rheostat (0-35 Ohm,10A), Nichrome wire wound rheostat on epoxy resin or class F insulating tube with two fixed and one sliding contact	IV
7	Rheostat (0-350Ohm,1.5A), Nichrome wire wound rheostat on epoxy resin or class F insulating tube with two fixed and one sliding contact	V
8	D. C. Supply, A 230 V d.c. supply (with inbuilt rectifier to convert a.c.to d.c)	V
9	Oil filled capacitor, 10 to 100μF Oil filled capacitor with rated voltage up to 500V	V
10	Electrolyte type capacitor, 10 to 100μF electrotype capacitor with rated voltage up to 500V	V
11	Galvanometer, (50mV-0-50mV) PMMC type analog portable galvanometer	V

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basic Electrical Parameters	1a. Distinguish the features of the given electric parameters. 1b. Explain the given terms. 1c. Describe the given effect of the electric current with a relevant application. 1d. Calculate work, power and energy for given circuit.	1.1 Direct Current (DC), Alternating Current (AC), Voltage Source and Current Source: Ideal and Practical. 1.2 Electric Current, Electric Potential, Potential Difference (P D), Electro-Motive-Force (EMF). 1.3 Electrical Work, Power and Energy. 1.4 Resistance, Resistivity, Conductivity, Effect of Temperature on Resistance. 1.5 Types of Resistor and their Application 1.6 Heating Effect, Magnetic Effect, Chemical Effect of Electric current.
Unit – II D.C. Circuits	2a. Apply Ohm's law to calculate internal resistance of a given circuit. 2b. Distinguish the given two parameters 2c. Calculate equivalent resistance for a given circuit. 2d. Apply Kirchhoff's laws to determine current and voltage in the given circuit.	2.1 Ohm's Law, Internal resistance of source, internal voltage drop, Terminal Voltage. 2.2 Resistance in Series, Resistance in Parallel. 2.3 Active, Passive, Linear, Non-linear Circuit, Unilateral Circuit and Bi-lateral Circuit, Passive and Active Network, Node, Branch, Loop, Mesh. 2.4 Kirchhoff's Current Law, Kirchhoff's Voltage Law.
Unit- III Capacitors	3a. Describe the construction of the given type of capacitor. 3b. Describe the working of the capacitor in given circuit. 3c. Calculate equivalent capacitance in given d.c. circuit. 3d. Plot charging and discharging curves for a given capacitor.	3.1 Capacitor, Parallel Plate Capacitor. 3.2 Various connections of capacitor. 3.3 Energy Stored in Capacitor. 3.4 Charging and Discharging of Capacitor. 3.5 Breakdown voltage and Di-electric strength. 3.6 Types of Capacitor and Application.
Unit– IV Magnetic Circuits	4a. Distinguish the given terms related to a magnetic circuit. 4b. Calculate various parameters of a given magnetic circuit. 4c. Plot B-H curve and hysteresis loop of a given magnetic materials. 4d. Compare the performance of the given series and parallel magnetic circuit.	4.1 Magnetic lines of force, flux, flux density, magnetic flux intensity. 4.2 Magneto-Motive-Forces (MMF), Ampere Turns (AT), Reluctance, Permeance, reluctivity. 4.3 Electric and Magnetic circuit: Series Magnetic and Parallel Magnetic Circuit. 4.4 Magnetization Curve (B - H Curve) 4.5 Magnetic Hysteresis, Hysteresis Loop., Applications.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– V Electromagnetic Induction	5a. Describe the use of Faraday's laws of electromagnetic induction in the given application. 5b. Distinguish between the given type of e.m.fs. 5c. Apply Faraday's laws to calculate induced e.m.f. in given circuit. 5d. Calculate self inductance and energy stored in magnetic field in given circuit.	5.1 Development of Induced e.m.f. and Current, Faraday's Laws of Electromagnetic Induction. 5.2 Static and dynamic emf, Lenz's Law, Fleming's Right hand rule. 5.3 Self Inductance, Coefficient of Self-inductance (L), Mutual inductance, Coefficient of Mutual inductance (M), self induced e.m.f. and mutually induced e.m.f, Coefficient of Coupling. 5.4 Inductance in series. 5.5 Types of inductor, their application and Energy Stored in Magnetic Field.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basic Electrical Parameters	11	02	06	04	12
II	D. C. Circuits	13	02	03	07	12
III	Capacitors	11	02	03	07	12
IV	Magnetic Circuits	13	02	04	08	14
V	Electromagnetic Induction	16	04	06	10	20
Total		**64**	**12**	**22**	**36**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Illustrate situations wherein electrical energy is required.
b. Prepare models in the form of mini-projects.
c. Prepare power point presentation related to basics of electrical engineering.
d. Prepare a chart of electric circuit elements and relevant industrial application.
e. Prepare question bank referring old MSBTE question papers.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.

b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
a. Guide student(s) in undertaking micro-projects.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. **Types of Electrical equipment**: Prepare chart showing real-life examples indicating various types of electrical equipment
b. **Resistance**: Collect photographs of resistances and prepare models of simple series circuit and parallel circuit.
c. **Capacitance:** Collect photographs of capacitance and prepare models of simple series circuit and parallel circuit.
d. **Inductance:** Collect photographs of inductance and prepare models of simple series circuit and parallel circuit.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	A Text Book of Electrical Technology Vol-I	Theraja, B. L. Theraja, A. K.	S.Chand and Co. New Delhi 2014 ISBN: 9788121924405
2	Basic Electrical Engg.	Mittle, V. N.	Tata McGraw-Hill, New Delhi ISBN : 978-0-07-0088572-5
3	Electrical Technology	Hughes, Edward	Pearson Education, New Delhi ISBN-13: 978-0582405196
4	Fundamentals of Electrical Engineering	Saxena, S. B. Lal	Cambridge University Press, New Delhi ISBN : 9781107464353
5	Basic Electrical and Electronics Engineering	Jegathesan, V.	Wiley India, New Delhi 2014 ISBN : 97881236529513

14. SOFTWARE/LEARNING WEBSITES

a. www.youtube.com
b. www.nptel.ac.in
c. www.wikipedia.com
d. www.electricaltechnology.org
e. www.howstuffworks.com
f. www.electrical4u.com

Program Name : **Electrical Engineering Program Group**
Program Code : **EE/EP/EU**
Semester : **Second**
Course Title : **Elements of Electronics**
Course Code : **22213**

1. RATIONALE

Diploma engineers have to deal with the various electronic components while maintaining various electrical systems. The study of basic operating principles and handling of various electronics devices will help them to troubleshoot electronics equipment used in electrical system. This course is developed in such a way that, students will be able to apply the knowledge to solve broad electronic engineering application problems in electrical engineering field.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Use electronic components and circuits in electrical equipment.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a. Use relevant diode in different electronics circuits.
b. Use diode in rectifiers and filters.
c. Use BJT and FET in electronics circuits.
d. Use DC regulated power supply.
e. Use Transistor as an oscillator.
f. Use of logic gates in electronics circuits.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
L	T	P			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.
***Legends:* L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.**

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

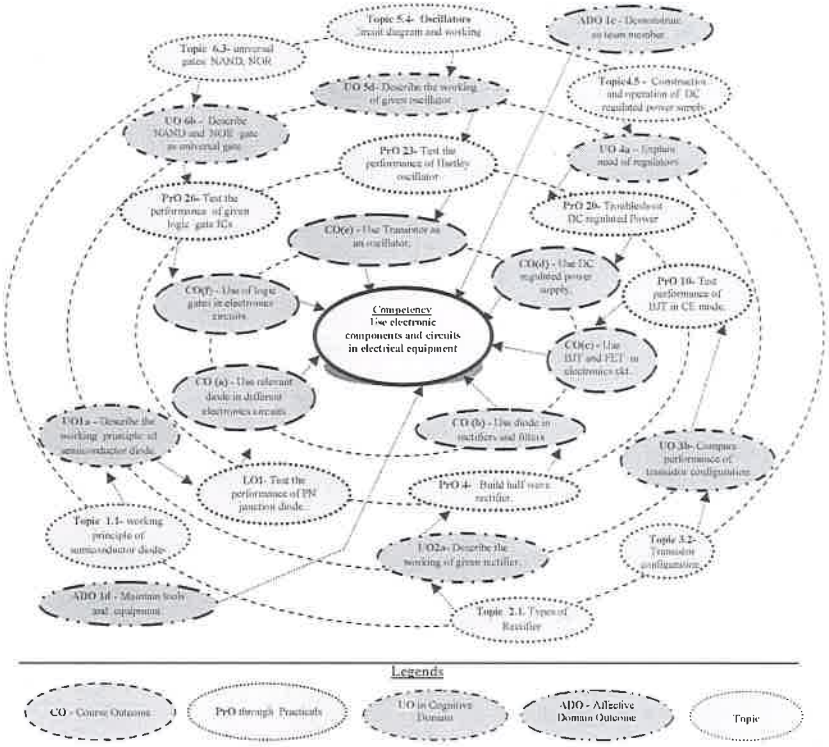

Figure 1 - Course Map

6. SUGGESTED PRACTICALS / EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Test the performance of PN junction diode.	I	02*
2	Test the performance of zener diode	I	02
3	Test the performance of photo diode by varying the light intensity as well as distance.	I	02
4	Build/test half wave rectifier on breadboard.	II	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
5	Build/ test full wave rectifier on breadboard using two diodes	II	02
6	Build/ test full wave rectifier on breadboard using four diodes	II	02
7	Use LC filter for getting minimum ripple using two diodes.	II	02
8	Use π filter for getting minimum ripple using four diodes.	II	02
9	Identify the terminals of the PNP and NPN.	III	02
10	Build and test zener voltage regulator for the given voltage.	IV	02
11	Test the various blocks of regulated DC power supply.	IV	02
12	Find out faults at different stages of regulated DC power supply.	IV	02
13	Troubleshoot given DC regulated power supply.	IV	02
14	Test the performance of Regulator IC's: IC's 78XX, 79XX.	IV	02
15	Test the performance of IC 723 as Regulator.	IV	02
16	Test the performance of given logic gate ICs.	VI	02
17	Test the performance of given flip flop ICs.	VI	02
		Total	**54**

Note

*i. A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
	Total	**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Maintain tools and equipment.
e. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs

according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organising Level' in 2nd year.
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Variable DC power supply 0- 30V, 2A, SC protection, display for voltage and current.	1, 2, 3, 9, 10,11, 12,13,14
2	Cathode Ray Oscilloscope Dual Trace 20Mhz, 1MegaΩ Input Impedance	4,5,6,7,8,9,15
3	Function Generator 0-2 MHz with Sine, square and triangular output with variable frequency and amplitude.	4,5,6,7,8,9
4	Digital Multimeter : 3 1/2 digit display, 9999 counts digital multimeter measures: V_{ac}, V_{dc} (1000V max) , A_{dc}, A_{ac} (10 amp max) , Resistance (0 - 100 MΩ) , Capacitance and Temperature measurement	All
5	Lux meter 3000 Lumen, Battery operated hand held type	3
6	Electronic Work Bench : Bread Board 840 -1000 contact points : Positive and Negative power rails on opposite side of the board , 0-30 V , 2 Amp Variable DC power supply, Function Generator 0-2MHz, CRO 0-30MHz , Digital Multimeter.	All
7	Digital IC Trainer: comprising of 0-30 V, 0-2 A, input/output switches along with LEDs, Bread Board 840 -1000 contact points, built in pulse generator.	16, 17
8	Universal IC Tester: Test a wide range of Digital IC's such as 74 Series, 40/45 Series of CMOS IC's, Test Microprocessors 8085, 8086, Z80 Test Peripherals like 8255, 8279, 8253, 8259, 8251, 8155, 6264,62256,8288,8284.,Auto search facility of IC's,40 pin DIP ZIF sockets provided,28 Touch Key pad with numerical and functional keys 9 Digit Seven Segment Display.	16, 17

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Semiconductor Diode	1a. Describe the construction and working principle of the given diode. 1b. Describe characteristics and application of the given diode. 1c. Describe application of the given opto-coupler. 1d. Compare performance parameters of the given devices.	1.1 Construction, symbol, working principle, specification, applications, forward and reverse biasing and V-I characteristic of following semiconductor diodes: PN junction diode, Zener diode. 1.2 Special diodes : LED, Photodiode, LASER diode and Power diode.
Unit – II Rectifiers and Filters	2a. Describe working of the given rectifier. 2b. Compare the performance of the given rectifiers. 2c. Describe the working of the given type of filter circuit. 2d. Calculate ripple factor, PIV and efficiency of the given type of rectifier. 2e. Justify the selection of rectifier for the given application.	2.1 Types of Rectifiers: Half Wave, Full Wave Rectifier (bridge and center tapped): circuit operation I/O waveforms for voltage and current. 2.2 Parameters of rectifier: Average DC value of current and voltage ripple factor ripple frequency PIV of diode, TUF and efficiency of rectifier. 2.3 Types of Filters: Shunt capacitor, Series inductor, LC and π filter.
Unit– III Transistor	3a. Differentiate the working of the given type of transistors 3b. Compare the performance of the given transistor configurations.	3.1 Different types of transistors: PNP, NPN 3.2 Transistor configurations: CB, CE, CC. 3.3 Transistor as a switch.
Unit– IV Regulators and power supply	4a. Explain concept of the given type of regulation. 4b. Calculate output voltage of the given regulator. 4c. Describe the working of the give type of as variable regulator.	4.1 Load and line regulation. 4.2 Basic Zener diode voltage regulator. 4.3 Regulator IC's: IC's 78XX, 79XX IC 723 as fixed, variable and Dual. Regulated DC power supply. 4.4 Construction and operation of DC Regulated power supply.
Unit– V Oscillators	5a. Explain the given type of feedback 5b. Compare the performance of the given two types of feedback. 5c. Calculate frequency of oscillations for the given data. 5d. Describe working of the given type of oscillator with circuit diagram.	5.1 Types of feedback: Positive feedback, Negative feedback. Barkhausen's criterion 5.2 Oscillator: Circuit Diagram and working of LC, RC and Crystal oscillator.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit–VI Digital Electronics	6a. Convert the given decimal number into binary, octal and hexadecimal number system. 6b. Describe the given gate to work as universal gate. 6c. Build the given logic operations with the given types of gates 6d. Construct the given type of flip flop with sketches.	6.1 Number System: binary, octal decimal and hexadecimal number system. 6.2 Boolean algebra: Demorgans Theorem. 6.3 Logic gates: Logic symbol, logical expression and truth table of AND, OR, NOT EX-OR and EX-NOR gates. 6.4 Universal gates: NAND and NOR. 6.5 Flip flop: Symbol, truth table and working of S R, J K, M S J K, T and D Flip flop.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Semiconductor Diode	06	2	4	2	08
II	Rectifiers and Filters	08	2	4	6	12
III	Transistor	12	3	9	6	18
IV	Regulators and power supply	08	3	4	5	12
V	Oscillators	06	3	4	3	10
VI	Digital Electronics	08	2	4	4	10
Total		**48**	**15**	**29**	**26**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Prepare journals based on practical performed in laboratory.
b. Test different diodes using CRO.
c. Give seminar on any relevant topic.
d. Library survey regarding different data books and manuals.
e. Prepare power point presentation for electronic circuits.
f. Undertake a market survey of different semiconductor components.
g. Trace various electronics components in electrical equipment.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide students for using data manuals.
f. Guide student(s) in undertaking micro-projects.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. **Diode**: Build a circuit on general purpose PCB to clip a positive half cycle at 1.5 v of a waveform with input signal 5Vpp., and prepare the report. **(Duration: 8-10 hours)**
b. **Diode:** Build a circuit on general purpose PCB to clamp a waveform at 3.0V using diode and passive components.
c. **Photodiode:** Build a circuit on breadboard to turn the relay on and off by using photo diode and prepare a report.
d. **Rectifier**: Build a half wave rectifier for 6V, 500mA output current on general purpose PCB.
e. **Rectifier**: Build a full wave bridge rectifier with capacitor filter for 6V, 500mA output current on general purpose PCB
f. **Voltage Regulator:** Build a circuit of DC regulated power supply on general purpose PCB for 9V and 500mA output.
g. **Oscillator:** Build circuit to generate audio frequency.
h. **Digital Electronics**: Build LED blinking circuit using suitable digital circuit.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Electronic Devices and Circuit Theory	Boylestead, Robert, Neshelsky, Louis	Pearson Education, New Delhi,2014, ISBN :
2	Electronic Devices and Circuit: An Introduction	Mottershead, Allen	Goodyear Publishing Co. New Delhi, ISBN : 9780876202654

S. No.	Title of Book	Author	Publication
3	The Art of Electronics	Horowitz, Paul Hill, Winfield	Cambridge University Press, New Delhi 2015 ISBN : 9780521689175
4	Fundamental of Electronic Devices and Circuits	Bell, Devid	Oxford University Press New Delhi, 2015, ISBN : 9780195425239
5	Electronic Devices and Circuit	Maini, Anil K.	Wiley India, New Delhi, ISBN : 9788126518951
6	Transistor Selector Handbook	-	Tower's International Foulsham. London (1974), ISBN: 9780572008888

14. SOFTWARE/LEARNING WEBSITES

a. www.nptel.iitm.ac.in
b. www.datasheetcafe.com
c. www.williamson-labs.com
d. www.futurlec.com
e. www.bis.org.in
f. www.learnerstv.com
g. www.cadsoft.io
h. www.khanacademy.

Program Name : **Electrical Engineering Program Group**
Program Code : **EE/EP/EU**
Semester : **Second**
Course Title : **Basic Mechanical Engineering**
Course Code : **22214**

1. RATIONALE

Electrical engineering is the basic engineering branch. Electric power supply is needed for running of mechanical and the chemical process equipment for which different electric motors are used. So in mechanical industry, the electrical engineer has to take care of various electrical installations with its maintenance. Knowledge of basic thermodynamics including steam engineering, boilers and refrigeration and air-conditioning will be useful for maintenance of related equipment. These equipment are used for generation of electrical power and maintenance of desired environment. Electrical engineer must have fundamental knowledge of fluid Mechanics and fluid machinery which is required in the operation of hydraulic power plants. Topics on air compressors and gas turbine also provide necessary guide lines for the maintenance of these equipment by electrical engineer. Further, this will help trouble free working of these equipment with saving in energy consumption.

2. COMPETENCY

The course should be taught and implemented with the aim to develop the course outcomes (COs) for the student to demonstrate the following competency needed by the industry:

- **Apply principles of Mechanical Engineering to solve broad-based engineering problems.**

3. COURSE OUTCOMES (COs)

The theory and practicals should be taught so that the student attains the cognitive, psychomotor and affective domain learning outcomes (LOs) at the respective and relevant taxonomy levels for the student to demonstrate the following COs required by the industry:

a. Check the broad based working of various types of boilers and steam turbines.
b. Check the broad based working of diesel engines and gas turbines.
c. Check the broad based working of Pelton replace Francis turbines.
d. Check the broad based working of air compressors.
e. Check the broad based working of refrigeration and air-conditioning systems.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory						Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
L	T	P			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PA** - Progressive Assessment*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

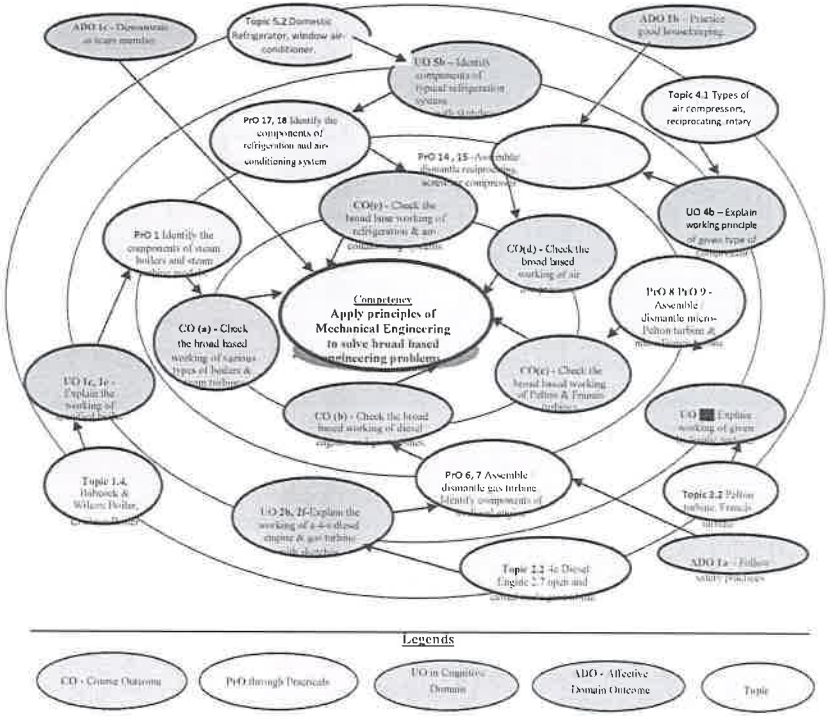

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	Basic Mechanical Engineering		
1	Identify the components of steam boilers model.	I	02
2	Identify the components of impulse and reaction turbine models.	I	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
3	Assemble / dismantle impulse turbine model.	I	02
4	Assemble / dismantle reaction turbine model.	I	02
5	Identify the components of gas turbine model.	II	02
6	Assemble / dismantle gas turbine model.	II	02
7	Identify components of 4-stroke diesel engine model.	II	02
8	Assemble / dismantle micro-Pelton turbine.	III	02
9	Assemble / dismantle micro-Francis turbine.	III	02
10	Assemble / dismantle hydraulic centrifugal pump.	III	02
11	Assemble / dismantle hydraulic jet pump.	III	02
12	Assemble / dismantle submersible pump.	III	02
13	Perform test on centrifugal pump to calculate overall efficiency.	III	02
14	Assemble / dismantle reciprocating air compressor.	IV	02
15	Assemble / dismantle screw compressor.	IV	02
16	Assemble / dismantle centrifugal compressor.	IV	02
17	Identify the components of refrigeration system (VCC).	V	02
18	Identify the components of air conditioning system (VCC).	V	02

Note

*i. A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
	Total	**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences.

a. Follow safety practices.
b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Maintain tools and equipment.
e. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of

practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organising Level' in 2nd year.
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Models of fire and water tube boilers.	1
2	Impulse and reaction turbine (Suitable for dismantling)	2,3,4
3	Model of Gas turbine. (Suitable for dismantling)	5,6
4	Single or multi cylinder 4-stroke diesel engine.	7
5	Micro-Pelton turbine.	8
6	Micro-Francis turbine.	9
7	Centrifugal pump. (Suitable for dismantling)	10
8	Hydraulic jet pump. (Suitable for dismantling)	11
9	Submersible pump. (Suitable for dismantling)	12
10	Test rig of centrifugal pump to find overall efficiency. (Compact test rig with digital display)	13
11	Two stage reciprocating air compressor. (Suitable for dismantling)	14
12	Screw air compressor. (Suitable for dismantling)	15
13	Centrifugal air compressor. (Suitable for dismantling)	16
14	Unitary refrigeration system. (VCC)	17
15	Unitary air-conditioning system. (VCC)	18

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Steam Boilers and Steam Turbines	1a. Describe given thermodynamic properties 1b. Interpret the specified thermodynamics law 1c. Explain the working of the specified boiler. 1d. Describe the function of the specified component of the	1.1 Specific volume, enthalpy, pressure, temperature, thermodynamic work 1.2 First and second law of thermodynamics 1.3 Basic concepts of wet steam, superheated steam, dryness fraction, degree of superheat. 1.4 Babcock and Wilcox boiler, Cochran boiler. 1.5 Various mountings and accessories (without construction details). 1.6 Layout of steam power plant. 1.7 Steam nozzles – continuity equation,

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	steam power plant. 1e. Explain the working of the given type of turbine with sketches	types of nozzles, Mach number, applications of nozzles. 1.8 Impulse and reaction turbines, necessity of compounding. 1.9 Control of pollution due to steam boilers.
Unit– II IC Engines and Gas Turbines	2a. Using sketches identify the specified component of the given type of IC engine. 2b. Explain the working of a 4-stroke diesel engine using sketches. 2c. Calculate brake thermal efficiency for the given data of an IC engines. 2d. Identify simple faults for the given situation of an engine. 2e. Identify the specified component in the sketch of the given type of gas turbine . 2f. Explain with sketches the working of given gas turbine with its applications 2g. Explain with sketches the construction and working of a given gas turbine with its applications.	2.1 Types of IC engines, components of IC engines. 2.2 4 stroke diesel engines. 2.3 BP, heat supplied and brake thermal efficiency of IC engines. 2.4 Common faults in IC engines. 2.5 Remedial measures to rectify the faults. 2.6 Types of gas turbines, applications of gas turbines 2.7 Open and closed cycle gas turbines. 2.8 Control of pollution due to gas turbines and diesel engines.
Unit– III Fluid Machinery	3a. Identify the specified component in the sketch of the given type of hydraulic turbine. 3b. Explain with sketches the working of the given hydraulic turbine. 3c. Identify the specified component in the sketch of the given type of hydraulic pump. 3d. Explain with sketches the working of given type of hydraulic pump. 3e. Calculate the overall efficiency of the given centrifugal pump avoiding velocity diagram.	3.1 Hydraulic turbines, nozzle and diffuser. 3.2 Pelton turbine, Francis turbine. 3.3 Input power of Pelton wheel. 3.4 Reciprocating and Rotary pumps. 3.5 Centrifugal pumps, submersible and jet pumps.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-IV Air Compressors	4a. Identify the specified component in the sketch of the given type of compressor 4b. Explain with sketches the working principle of the given type of compressor. 4c. Select the relevant compressor to be used for the given application with justification. 4d. Suggest the method to reduce energy consumption with justification.	4.1 Types of Air compressors: two stage reciprocating air compressor, screw compressors, centrifugal compressors. 4.2 Methods to reduce power consumption of air compressors.
Unit –V Refrigeration and Air-conditioning	5a. State the HVAC requirement for the given situation. 5b. Identify components of typical refrigeration system in the given diagram with justification. 5c. Explain with sketches the working of specified refrigeration and/or air conditioning system. 5d. Identify the problem for the given failure of the component with justification. 5e. Suggest the solution for energy saving in the given simple situation with justification.	5.1 HVAC; Refrigeration, air-conditioning, ton of refrigeration, major components of vapour compression systems. 5.2 Domestic refrigerator and window air-conditioner. 5.3 OLP, thermostat, starting relay, defrost heaters used domestic in refrigerator and HP/LP cutouts. 5.4 Types of air-conditioning systems - window, package, central air-conditioning systems. 5.5 Basic fault finding in refrigerator and window air-conditioner. 5.6 Methods of energy saving in refrigeration and air-conditioning systems.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Steam Boilers and Steam Turbines	14	04	08	08	20
II	IC Engines and Gas Turbines	12	02	06	06	14
III	Fluid machinery	06	02	04	06	12
IV	Air Compressors	06	02	02	04	08
V	Refrigeration and Air-conditioning.	10	04	06	06	16
	Total	**48**	**14**	**26**	**30**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student -related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journals based on practical performed in laboratory.
b. Prepare a seminar on boilers used in power plants.
c. Prepare a seminar on boilers control systems used in boiler.
d. Study circuit diagram for starting motor of IC engines and Battery Ignition system.
e. Prepare a power point presentation on hydraulic turbines.
f. Collect videos, animations showing working of different types of air compressors.
g. Make a troubleshooting chart for Domestic refrigerators.
h. Collect manufacturer's specifications for various refrigeration controls.

11. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide student(s) in undertaking micro-projects.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet -based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. **Steam Boilers and Turbines** – Draw electrical lay out of any one power plant (08 to 10 hours).
b. **IC Engines** - Collect leaflets of Diesel engine generator sets from market. Analyze and compare the specifications. (At least 04 different manufacturers) (08 to 10 hours).
c. **Gas Turbines** - Collect data of gas turbines used for power plants of different capacities from internet and list features like type, power, speed, fuel used. (At least 04) (08 to 10 hours).
d. **Hydraulic Turbines** - Prepare charts showing parts of different types of commonly used hydraulic turbines from reference books. (08 to 10 hours).

e. **Air Compressors** - Prepare charts of wiring diagram for a 2-stage compressor having an auto cutoff solenoid valve available in laboratory or visiting an industry (8 to 10 hours).
f. **Refrigeration systems** - Students will make charts of wiring diagram of latest 02 each refrigerator / window air-conditioner available in market. (08 to 10 hours).
g. **Refrigeration controls** – Make models of refrigeration controls demonstrating their functioning (at-least 02) in institute workshop / laboratory under guidance of teacher.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Elements of Mechanical Engineering	Manglik, V. K.	PHI Learning Pvt. Ltd., New Delhi, 2013, ISBN: 9788120346291
2	Basic Mechanical Engineering	Agrawal, Basant; Agrawal, C. M.	WILEY India Pvt. Ltd., New Delhi, 2008, ISBN: 9788126518784

14. SOFTWARE/LEARNING WEBSITES

a. http://www.instrumentationengineers.org/2013/06/working-principle-of-impulse-turbines.html
b. https://www.youtube.com/watch?v=AyAd-gLO9CE
c. https://www.youtube.com/watch?v=s2WGFELXPNg
d. https://www.youtube.com/watch?v=gqNtoy2x5bU
e. https://www.grc.nasa.gov/www/k-12/airplane/engopt.html
f. https://powergen.gepower.com/resources/knowledge-base/what-is-a-gas-turbine.html
g. https://www.youtube.com/watch?v=Jd5BN7SPkqI
h. www.sakshat.ac.in

Program Name: All Branches of Diploma in Engineering and Technology.

Program Code: CE/CR/CS/CH/PS/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/MU/EE/ EP/EU/IS/IC/AE /FG/ME/PG/PT/DC/TX/TC

Semester : Second

Course Title : Business Communication Using Computers

Course Code : 22009

1. RATIONALE

Communication is the key factor for smooth and efficient functioning of any industry or business activity. Effective business communication is the lifeblood of any organization and is required to maintain quality and progress. The efficacy of business communication skills are essential for engineering professionals for instructing, guiding and motivating subordinates to achieve desired goals at work place. It is very crucial for an entrepreneur to run organization successfully by communicating effectively and skillfully with employees, customers and investors. Thus this course has been designed to enhance the skills to '*Communicate effectively and skillfully at workplace.*'

2. COMPETENCY

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences

- **Communicate effectively and skillfully at workplace.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following ***industry oriented*** COs associated with the above-mentioned competency:

a. Communicate effectively by avoiding barriers in various formal and informal situations.
b. Communicate skillfully using non-verbal methods of communication.
c. Give presentations by using audio- visual aids.
d. Write reports using correct guidelines.
e. Compose e-mail and formal business letters.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Theory							Practical					
				Paper	ESE		PA		Total		ESE		PA		Total	
L	T	P		Hrs.	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
--	--	2	2	--	--	--	--	--	--	--	35@^	14	15~	06	50	20

(~[1]): For only practical courses, the PA (15 marks) has two components under practical marks i.e. the assessment of practical has a weightage of 60% (i.e.09 marks) and micro-project assessment has a weightage of 40% (i.e.06 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: *L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

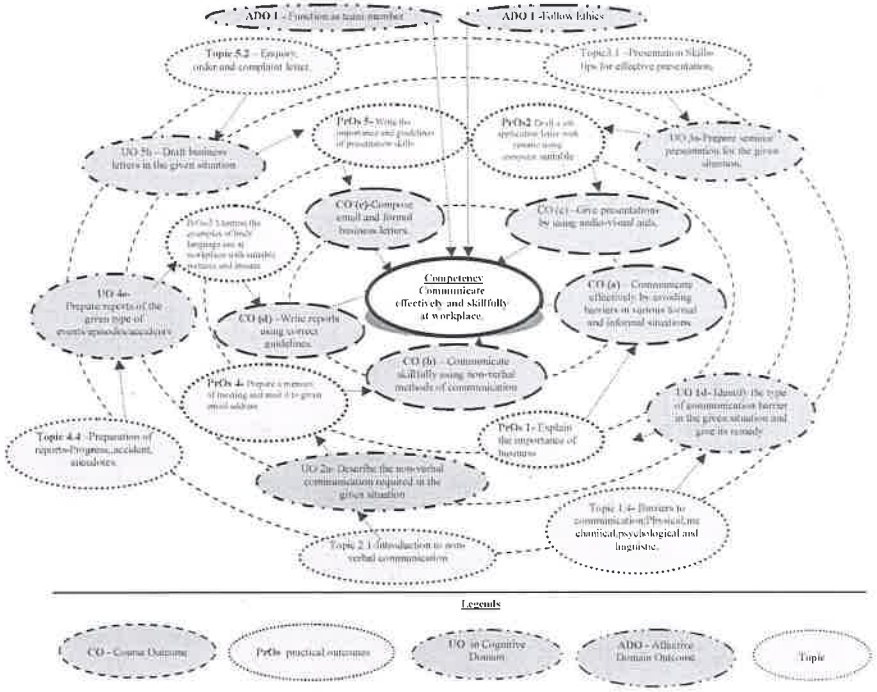

Figure 1 - Course Map

6. SUGGESTED PRACTICALS ACTIVITIES / EXERCISES (Integrate the theory in the laboratory when conducting practical)

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Explain the importance of business communication for an organization using case study	I	2*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
2	Draft a job application letter with resume using computer.	V	2*
3	Mention the examples of body language use at workplace with suitable pictures and images.	II	2*
4	Prepare a minutes of meeting and mail it to given email address	VI	2
5	Write the importance and guidelines of presentation skills.	III	2*
6	Draft a detailed Progress Report.	IV	2*
7	Organize a debate on types of communication.	I & III	2
8	Summarize an industry report using techniques of summarizing.	IV	2
9	Draft a complaint letter on given topic.	V	2
10	Design PowerPoint presentation on any technical topic.	III	2*
11	Explain the eight principles of effective communication.	I	2*
12	Explain various non-verbal codes with examples.	II	2
13	Explain the importance of personal appearance stating tips of grooming for a professional.	II	2*
14	Draft a memo on given topic.	V	2
15	Present any Two barriers to communication using case study.	I	2*
16	Present a technical paper using IEEE format.	III	2*
			32

Note

i. A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as '' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry. The size of batch for the practical should not exceed more than 21 students strictly for the maximum attainment of COs and PrOs.*

ii. Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

7. MAJOR EQUIPMENTS / INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	LCD Projector	All
2	Smart Board with networking	All
3	Language lab with internet	All
4	Printer	Wherever Applicable

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	Speaking Skills	
Unit – I Introduction to Business Communication	1a. Describe the importance of the business communication in the given situation. 1b. Identify the missing element in the given communication process. 1c. Identify the type of communication in the given situation. 1d. Identify the type of communication barrier in the given situation and its remedy.	1e. Use different types of verbal and non–verbal communication for the given situation.	1.1 Introduction to Communication- Elements, Importance, Functions. 1.2 Types (meaning and importance) –Verbal (Oral-Written), Formal, Informal, Vertical, Horizontal and Diagonal communication. 1.3 Principles of effective communication. 1.4 Barriers to communication - Physical, mechanical, psychological and linguistic. 1.5 Business communication: Meaning, characteristics and importance.
Unit– II Non-Verbal Communication	2a. Describe the non-verbal communication required in the given situation. 2b. Describe personal appearance required in the given communication situation. 2c. Describe the given facial expressions.	2d. Use relevant facial expressions in the given situation. 2e. Answer questions after listening to presentations.	2.1 Introduction to Non-Verbal communication (Meaning and importance) 2.2 Body Language: Aspects of body language: gestures, eye contact, posture, facial expressions, personal appearance (dressing and grooming) vocalics. 2.3 Body language - positive and negative body language.
Unit– III Presentation skills	3a. Prepare seminar presentation for the given situation. 3b. Prepare debate points 'for' and 'against' the given topic. 3c. Prepare the points for computer presentation	3d. Make seminar presentation 3e. Participate in debate speaking 'for' or 'against' the given topic. 3f. Make effective	3.1 Presentation skills- tips for effective presentation. 3.2 Guidelines for developing power point presentation. 3.3 Presenting Technical papers.

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	Speaking Skills	
	for the given topic.	computer presentations	
Unit– IV Office Drafting	4a. Draft the given notice using the relevant format. 4b. Draft the given memorandum using the relevant format. 4c. Prepare agenda for the given type of meetings. 4d. Prepare minutes of the given type of meetings. 4e. Prepare reports of the given type of events/episodes/ accidents	4f. Read the agenda of the given meeting. 4g. Read the report of the given event. 4h. Initiate telephone calls for given situation. 4i. Answer official phone calls for given situation.	4.1. Office drafting: Formats and Guidelines. 4.2. Formulating notices and memoranda. 4.3. Preparation of agenda and writing minutes of meetings. 4.4. Preparation of reports- progress reports, Accident reports, case study. 4.5. Summarizing techniques.
Unit-V Business Correspondence	5a. Respond to given job advertisements by writing your CV/ Resume. 5b. Draft business letters in the given situations. 5c. Draft complaint letters for the given situations. 5d. Compose E- mails with relevant for the given situation.		5.1 Business correspondence. 5.2 Enquiry, order and complaint letters. 5.3 E-mails- netiquettes. 5.4 Difference –Curriculum Vitae, Bio-data and Resume. 5.5 Job application and resume writing

Note: To attain the COs and competency, above listed Learning Outcomes (UOs) need to be undertaken to achieve the 'Application Level' of Blooms's 'Cognitive Domain Taxonomy' Theory related topic should be covered during practical hours using multimedia.

9. SUGGESTED SPECIFICATION TABLE FOR INTERNAL END SEMISTER EXAMINATION

Unit No.	Unit Title	Distribution of practical Marks			
		R Level	U Level	A Level	Total Marks
I	Introduction to Business Communication	02	02	01	05
II	Non-verbal Communication	02	01	02	05
III	Presentation Skills	02	01	02	05
IV	Office Drafting	02	04	04	10
V	Business Correspondence	02	04	04	10
	Total	**10**	**12**	**13**	**35**

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)
Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of PrOs and UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED GUIDELINES FOR ASSESSMENT TOOL TO CONDUCT INTERNAL END SEMETER EXAM (ESE) .

Weightage (20 Marks) A	Weightage (15 Marks) B	Total
Assessment based on PrOs, practicals conducted during semester Based on computer and written skill. (Minimum four questions each five marks) Sample questions: Eg. I Draft an email to The manager regarding the shortage of raw material at production department. Note-submit the printout of mail. (Computer based) **Eg. II Write job application with resume. (written)**	**Oral examination based on UOs Topics mentioned in syllabus. (Minimum five questions each two marks to be asked) Eg. I Explain the importance of communication in professional life. II. State any four guidelines of presentation skills.**	**(35 Marks) A+B** **Duration: 2 hours**

SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Collect good articles from newspapers and magazines and read them with correct intonation.
b. Listen to Business news on TV and radio.
c. Watch videos of effective presentations on television and open learning sources for presentation skills and body language.
d. Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.

b. ***'L' in item No. 4*** does not mean only the traditional lecture method. but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
a. Arrange various communication activities using functional grammar.
b. Show video/animation films to develop listening skills and enhance vocabulary.
c. Use real life situations for explanation.
d. Prepare and give oral presentations.
e. Guide micro-projects in groups as well as individually.

12. SUGGESTED TITLES OF MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of CrAs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement*** hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. Study the personal appearance and grooming of employees visiting sales store, shopping mall in the vicinity.
b. Comparative study of Bio-data, Resume and Curriculum vitae.
c. A detailed study of guidelines required for presentation skills.
d. Summarize technical content using English newspaper, magazines or online resources.
e. Prepare a booklet on aspects of body language in pictorial form.
f. A detailed study of the importance, of technical paper of technical paper presentation.
g. Case study on the importance of Business communication in an organization.
h. Report on various formal/business activities.
i. Study of oral presentation of famous business leader.
j. Detailed study of business etiquettes observed in organization.
k. Summarize the business article with the help of English newspapers/magazines and other sources.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Effective Communication Skills	M Ashraf Rizvi	Tata McGraw-Hill

S. No.	Title of Book	Author	Publication
2	Communication Skills	Sanjay Kumar and Pushp Lata	Oxford University Press
3	Personality Development and Soft Skills	Barun K. Mitra	Oxford University Press

14. SOFTWARE/LEARNING WEBSITES

a. https://www.britishcouncil.in/english/learn-online
b. http://learnenglish.britishcouncil.org/en/content
c. http://www.talkenglish.com/
d. languagelabsystem.com
e. www.wordsworthelt.com
f. www.notesdesk.com
g. http://www.tutorialspoint.com
h. www.studylecturenotes.com
i. totalcommunicator.com
j. www.speaking-tips.com